Students' Reflective Thinking Ability in Solving Mathematics Problems Assessed From Students' Learning Style

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Abstract

This study aims to describe students' reflective thinking skills in solving mathematics problems in terms of the learning styles of junior high school students. This type of research was descriptive qualitative research. The research subjects were students of class VIII at SMP Negeri 1 Candimulyo, Magelang Regency, in the academic year 2020/2021. The subjects of this study were 2 visual learning style students, 2 auditory learning style students, and 2 kinesthetic learning style students. Data collection techniques in this study were learning style questionnaires, tests of reflective thinking skills, and in-depth interviews. Triangulation in this study using source triangulation. The results of this study indicate that subjects with visual and auditory learning styles can meet the reflective thinking ability phase (Reacting, Comparing, and Contemplating) with each indicator being met so that the subject was at a reflective level. Kinesthetic learning style subjects were able to meet the reflective thinking ability phase (Reacting, Comparing, and Contemplating) but several indicators were not fulfilled, so the subject was at a fairly reflective level. Therefore, the profiles of students' reflective thinking skills in visual and auditory learning styles were both at a reflective level, while the profiles of students' reflective thinking skills in kinesthetic learning styles were different because they were at a sufficiently reflective level.

Keywords: Reflective Thinking Ability, Matthematics Problem Solving, Learning Style.

Abstrak

Penelitian ini bertujuan untuk mendeskripsikan kemampuan berpikir reflektif siswa dalam menyelesaikan masalah matematika ditinjau dari gaya belajar siswa SMP. Jenis penelitian ini adalah penelitian kualitatif deskriptif. Subjek dalam penelitian ini adalah siswa kelas VIII di SMP Negeri 1 Candimulyo Kabupaten Magelang Tahun Pelajaran 2020/2021. Subyek penelitian ini adalah 2 siswa gaya belajar visual, 2 siswa gaya belajar auditori, dan 2 siswa gaya belajar kinestetik. Teknik pengumpulan data dalam penelitian ini adalah angket gaya belajar, tes kemampuan berpikir reflektif, dan wawancara mendalam. Triangulasi dalam penelitian ini menggunakan triangulasi sumber. Hasil penelitian ini menunjukkan bahwa subjek dengan gaya belajar visual dan auditori dapat memenuhi fase kemampuan berpikir reflektif (*Reacting*, *Comparing*, dan *Contemplating*) dengan masing-masing indikator terpenuhi sehingga subjek berada pada level reflektif. Mata pelajaran gaya belajar kinestetik mampu memenuhi tahap kemampuan berpikir reflektif (*Reacting*, *Comparing*, and *Contemplating*) namun beberapa indikator tidak terpenuhi, sehingga subjek berada pada taraf cukup reflektif. Oleh karena itu, profil kemampuan berpikir reflektif siswa pada gaya belajar visual dan auditori sama-sama berada pada level reflektif, sedangkan profil kemampuan berpikir reflektif siswa pada gaya belajar kinestetik berbeda karena berada pada level cukup reflektif.

Kata kunci: Kemampuan Berpikir Reflektif, Pemecahan Masalah Matematika, Gaya Belajar

Introduction

Mathematics is a branch of science that has an important role in human life (Hartono, 2019). The knowledge gained from studying mathematics can be used to solve social, economic, and other problems (Kusumaningsih et al., 2020). Mathematics is a science in the form of a tool for thinking, communicating, or as a tool for solving problems in various practical problems (Khasmawati et al., 2018; Azizah et al. 2019).

Solving mathematical problems requires a process of thinking and reasoning (Happy & Listyani, 2011; Happy et al., 2019; Hartono, 2018). This agrees with Sugiyanti et al. (2018) which states that solving a problem to find a way out of difficulty faced, achieving a goal where that goal is not immediately achieved. The ability that a student has in thinking has different capacities from one student to another. Thus the ability of students is needed in the world of education so that teachers can convey learning appropriately. One of the mathematical thinking skills that support students in solving math problems is the ability to think reflective (reflective thinking). As Alfiansyah (2016) argues, one of the thinking skills that support students' problem-solving skills in learning mathematics is reflective thinking. Following the needs of a student in solving mathematical problems he faces in everyday life.

Suharna (2012) states that reflective thinking is a process of activities that are directed and precise where individuals are aware of being followed, analyze, evaluate, motivate, gain deep meaning, and use an appropriate learning strategy. Beside, Suharna (2012) also states that reflective thinking is an awareness of what is known and what is needed. This is very important to bridge the learning situation gap. Reflective thinking according to Genarsih et al (2015) can be described as information or data that is used to respond, comes from within (internally), can explain what has been done, realizes mistakes and corrects them and communicates ideas with symbols or pictures, not by a direct object.

From some of the opinions above, it can be concluded that the ability to think reflective is an ability to think that connects the newly acquired knowledge with old knowledge so that a new conclusion can be obtained to solve an existing problem (Scanlan & Chemomas, 1997). According to Ariestyan et al (2016), the ability to think reflective is very appropriate in solving a mathematical problem. To find out the extent of students' reflective thinking skills, a teacher must carry out a series of activities that can help students bring out their reflective thinking skills. One of the activities that can be done is solving math problems, including problems in everyday life.

However, so far the ability to think reflective has received less attention among teachers (Nindiasari et al., 2014). Where a teacher pays more attention to the final results obtained by students in solving math problems than how a student processes in solving these problems. If this situation continues, it will result in the lack of knowledge that a student has due to a lack of knowledge and understanding of a problem he is facing (Ariestyan et al, 2016). This was one of the factors that cause students to underdeveloped mathematical reflective thinking skills (Nindiasari, 2013; Alfiansyah, 2016).

Students' reflective thinking ability can be measured by several indicators (Ariestyan et al., 2016) presented in Table 1. Furthermore, fro the achievement of these indicators, Putri and Mampouw (2018) creates the level of reflective thinking ability.

a. Level 1: Less Reflective. Students are said to be less reflective because they only go through the Reacting level, which can understand the problems they face through some of the indicators above.

b. Level 2: Self Reflective. Students are said to be quite reflective because they can go through the Reacting and Comparing levels, namely being able to understand the problem as well as explain the answers to the problems that have been obtained, linking existing problems with other problems that are almost the same and have been faced.

c. Level 3: Reflective. Students are said to be reflective because they can go through the levels of Reacting, Comparing, and Contemplating, namely being able to make conclusions based on understanding what is being asked, relating to problems that have been faced, determining the purpose of the problem, being able to correct and explain if the answers expressed are wrong.

Table 1. Indicators of Reflective Thinking Ability

No	Description of Reflective Thinking Phase
1	Reacting (thinking reflection for action), in this phase the things that must be done by students are: a. State what is known. b. Say whatever is asked. c. State the relationship between what is asked and what is known. d. Being able to explain what is known is sufficient to answer the question asked. e. Mention or explain methods that are considered effective for solving problems.
2	Comparing (reflective thinking for evaluation), in this phase students do the following: a. Explain the meaning of the problem obtained. b. Connecting the problems asked with problems that have been encountered. c. Explain the relationship between the problems asked and the problems that have been encountered.
3	Contemplating (reflective thinking for critical inquiry), in this phase students, do the following: a. Determine the answer to the problem. b. Detect the truth in determining the answer. c. Detect if there is an error in determining the answer. d. Correct and explain if there is an error from the answer. e. Conclude correctly.

According to Mentari et al (2018) the ability to think reflective is very important because reflective thinking is one of the higher-order thinking abilities. By having this thinking ability, a student will know what he needs in the learning process. Maharani (Utami et al, 2020) stated that in learning mathematics, it is not uncommon to find a difference that is owned by each student in receiving and processing information provided by the teacher. The way students concentrate on internal processes, remember information, new and difficult experiences, and students' habits in treating their experiences are known as learning styles (Sundayana, 2016; Ma & Ma, 2014). DePorter and Hernacki (Jaenudin et al, 2017) state that learning styles are the key to developing performance in work, school, and in interpersonal situations, so learning styles will affect achievement.

According to Hidayatulloh (2015) and Kurniawan and Hartono (2020), there are 3 models of learning styles that students have, namely: visual, auditory, and kinesthetic learning styles. Papilaya and Huliselan (2016) state that students with visual learning styles tend to learn by seeing, reading, observing, or looking. The strength of the visual learning style lies in the sense of sight, namely the eyes. For students who have a visual learning style, the eye is the main key to capturing any stimulus or stimulation during the learning process. Students with auditory learning styles tend to learn by listening. Students with auditory learning styles predominantly use the sense of hearing, namely ears to carry out learning activities. They will more easily perceive stimuli or stimuli when through the sense of hearing (ears). Students with kinesthetic learning styles tend to learn by moving, working, and touching. The strength of the kinesthetic learning style lies in the sense of taste and physical movements. Students who have a kinesthetic learning style will find it easier to obtain information by doing experience, movement, and touch. The three learning styles do not develop in a balanced manner but there is one that stands out from the learning styles that students have (Happy et al., 2020).

Each learning style has certain characteristics. This agrees with Sundayana (2016) that students with visual learning styles are neat and orderly students; good long term planner and organizer; meticulous with detail; fast and determined reader; and so forth. Students with auditory learning styles are students who talk to themselves while working; find it difficult to write, but better at telling stories;

likes to talk, discuss and explain things at length; and so forth. The students with the kinesthetic learning style are students who speak slowly; use words that contain actions; possibly bad writing; and so forth.

From the opinion above, it will certainly affect the differences in achieving indicators of the ability to think reflective of each student visually, auditory, and kinesthetic. Therefore, this study aims to describe the ability to think reflective in solving mathematics problems in terms of the learning styles of junior high school students in the material of Linear Equation with Two Variables.

Method

This research was descriptive qualitative. The research subjects were students of class VIII D and VIII F SMP Negeri 1 Candimulyo in the academic year 2020/2021 which had criteria, namely: having a visual, auditory, or kinesthetic learning style; have received material on the Linear Equation with Two Variables; students can communicate verbally and in writing well; students have the same math skills; and students are of the same age. The main instrument in this research was the researcher himself. The assistive instruments used in this study were a learning style questionnaire, tests of reflective thinking skills and interview guidelines. These three assistive instruments have previously been declared valid according to the validator.

Before collecting research data, the stage of selecting research subjects who meet the criteria was carried out. The first stage was to provide a learning style questionnaire instrument consisting of 39 statements about student learning habits. The second stage was to check the results and correct students' answers and categorize students into their respective learning styles, namely visual, auditory, and kinesthetic learning styles. The data from the student learning style questionnaire can be seen in Table 2. After categorized according to their respective learning style categories, the researcher chose 2 students as the beginning of the research subject and was able to take the subject back when the data obtained did not adequately reveal students' reflective thinking skills in solving math problems. Selected research subjects were AUW and WTU subjects for visual subjects, ACP and NIM subjects for auditory subjects, and ZEA and IAL subjects for kinesthetic subjects.

Table 2. Student Learning Style Questionnaire Test Results

Class	Visual Learning Style	Auditory Learning Style	Kinesthetic Learning Style	Number of Students
VIII D	8	7	2	17
VIII F	9	5	2	16
Total	17	12	4	33

The next stage, the researcher conducted a written test of reflective thinking skills and conducted interviews with research subjects. The collected data were analyzed using three steps: 1) Data reduction; 2) Presentation of data; and 3) Data Verification and Conclusion Drawing. The validity of the data in this study used a source triangulation, which is to test the credibility of the data by checking the data that has been obtained in the study through several different data sources, then the data that has been obtained was analyzed by the researcher to produce a conclusion, then an agreement was asked (member check) with the data source.

Result and Discussion
Students' Reflective Thinking Ability in Solving Mathematical Problems in Visual Learning Style

Based on the results of the answers to the tests of reflective thinking skills and interviews that have been carried out to the two selected visual learning style research subjects, namely the AUW and WTU subjects in solving math problems, in the Reacting phase the two subjects 1) were able to say

what was known in the questions correctly, precise, and complete; 2) the subject can say what was being asked in the question correctly and precisely; 3) the subject can mention the relationship between what was known and what was asked correctly and by making mathematical modelling precisely; 4) the subject has also been able to state that what was known from the questions is sufficient to answer the problems given by giving a response "The information I have obtained is sufficient to solve the above questions"; and 5) the subject can state the method that was considered the most effective to solve the given problem correctly by giving a response "using mixed methods to solve Linear Equation with Two Variables". Following the results of research by Jaenudin et al (2017) which states that students in visual learning styles always give first what was known and asked, and students can determine between relevant data and irrelevant data from the problem in the questions given.

In the Comparing phase, the subject of the visual learning style during the written test was incomplete in writing the meaning of the problems given in the questions. The written test answers for the WTU subject in the Comparing phase can be seen in Figure 1.
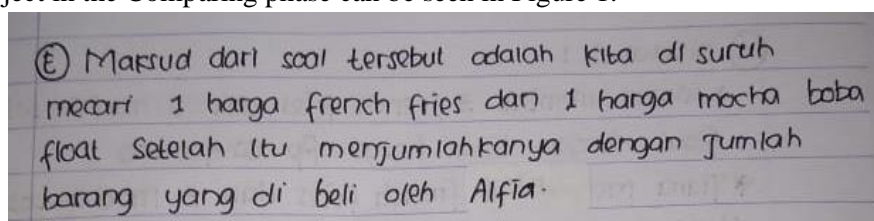

Figure 1. Written answers to the WTU subject in the Comparing phase

However, at the time of the interview, the WTU subject was able to complete the meaning of the problems given correctly and precisely. This can be seen in the results of WTU response, namely "The point of the question is that we have to find the price per unit of French-fries and mocha boba float after that add them up to the number of items purchased by Alfia. Then looking for Alfia's change". Besides, at the comparison stage, the two subjects were able to connect and relate the problems being asked to problems that have been faced before with short answers, such as "I have worked on questions like this but are slightly different, I use the elimination model and the substitution model to solve that matter". This was in line with Sundayana (2016), students in visual learning styles tend to answer questions with short answers.

In the Contemplating phase, the visual learning style subject can determine the answer to the problem given correctly, precisely and neatly, even though at the time of the interview the subject only reads the results of the answer, not the calculation process. This was in line with Happy et al (2020), students in visual learning styles tend to be neat, orderly, careful with details, and often know what to say but were not good at choosing words to express it. Also, the visual subject can detect the truth of the answers that have been previously obtained. This was proven during the interview, the subject believed that he had done carefully by giving the response "I am sure my answer was correct because I had calculated it carefully". Visual subjects were also able to make conclusions from the problems given in the questions correctly and accurately. This was following the results of research by Jaenudin et al. (2017) which states that visual learning style students can do calculations correctly and can evaluate/check the truth of an argument based on the concepts/properties used clearly.

Based on the description above, it can be seen that the visual learning style subject can go through the three phases of reflective thinking, namely Reacting, Comparing, and Contemplating with each indicator of each phase of reflective thinking being fulfilled. Therefore, the visual learning style subject can be said to have reached the level of reflective thinking ability at the Reflective level. This was following the opinion of Mentari et al. (2018) which states that students in visual and auditory learning styles have a higher reflective thinking ability than students in kinesthetic learning styles.

Students' Reflective Thinking Ability in Solving an Auditory Learning Style Mathematical Problem

Based on the results of the answers to the tests of reflective thinking skills and interviews that have been conducted to the two selected auditory learning style research subjects, namely the ACP and NIM subjects in solving math problems, in the Reacting phase when the written test the subject was incomplete in writing what was known and what was asked in the question. However, during the interview, the two subjects were able to correctly and completely reveal and complete the shortcomings of what was known and what was asked of the questions. The ability of auditory subjects who can provide more detailed responses when asked through interviews was following the opinion of Sundayana (2016) that students in auditory learning styles tend to find writing difficulties but were greater at telling stories. The written test answers for the ACP and NIM subjects in the Reacting phase can be seen in Figure 2 and Figure 3.

Figure 2. Written answers to the ACP subject in the Reacting phase

Figure 3. Written answers to the NIM subject in the Reacting phase

The incomplete written answers in Figure 2 and Figure 3 can be completed correctly by both subjects through the interview. The responses of the ACP and NIM subjects were as follows.

R-22 : What information do you get from the questions?
ACP-22 : It is known that a shop "Waiki" in Magelang sells various types of drinks and snacks and provides a 12% discount. Asked how much change Alfia would receive. Wulan bought 3 french-fries and 2 mocha boba floats for a total price of Rp 80.400,00, Tiara bought 4 french-fries and 3 mocha boba floats for a total price of Rp 111.600,00, Alfia bought 2 french-fries and 2 mocha boba floats by paying Rp 100.000,00.
NIM-33 : The information I got from the question was that Wulan bought 3 french-fries and 2 mocha boba floats for Rp 80.400,00, Tiara bought 4 french-fries and 3 mocha boba float for Rp 111.600,00. Asked the price to buy 2 french-fries and 2 mocha boba float for Alfia? And asked Alfia's change.

In this Reacting phase, the two auditory subjects were able to mention what was asked from the questions given; the subjects were also able to relate what was known to what was asked in the questions by making appropriate and correct modelling; the subject has also been able to state that what was

known from the question is sufficient to answer the problem given by the response member "is enough to solve the question"; and the subject was able to state the method that was considered the most effective to solve the given problem correctly and correctly, namely the mixed method to solve the Linear Equation with Two Variables. This was following the results of research by Jaenudin et al. (2017) which states that auditory learning style students can determine between relevant data and irrelevant data from the problems given in the questions.

In the Comparing phase, the subject of the auditory learning style can explain the meaning of the problems obtained in the questions correctly and correctly. However, the two auditory learning style subjects were less able to explain similar problems they had faced even though both were able to explain their relationship with the problems they were facing today. This can be seen from the responses given by the following ACP and NIM subjects.

ACP-28   : For the problem, I forgot a little, what clear was there were many and the methods that have been used for these problems were mixed methods. Relating to the current problem, both use the same method to solve the problem.

NIM-40   : Ever. We calculate first x or y using the elimination method first then substitution and find the final result.

The responses of these two subjects were different from the results of research by Jaenudin et al (2017) which states that great auditory subjects tell what they remember. However, at this stage, the two subjects had difficulty explaining a similar event they had experienced, even though both subjects could explain that the problem in question could be solved by Linear Equation with Two Variables.

In the Contemplating phase, the auditory learning style subject can determine the answer to the problem given correctly, precisely and at the time of the interview the subject can explain the calculation process even though it was not perfect. This agrees with Sundayana (2016) which states that auditory learning style students tend to speak fluently was better at spelling than writing also like to speak and explain at length. The subjects were also able to detect the truth of the answers that have been obtained previously by giving the response "I have researched and I am sure". The subjects have also been able to make conclusions from the problems given in the questions correctly and correctly. This was following the results of research by Jaenudin et al (2017) which states that auditory learning style students can do calculations correctly and can evaluate/check the truth of an argument based on the concepts/properties used clearly.

Based on the description described above, it can be seen that the auditory learning style subject can go through the three phases of reflective thinking, namely Reacting, Comparing, and Contemplating with each indicator of each phase of reflective thinking being fulfilled. Therefore, the auditory learning style subject reaches the level of reflective thinking ability at the Reflective level. This was following the opinion of Mentari et al. (2018) which states that students in visual and auditory learning styles have a higher reflective thinking ability than students in kinesthetic learning styles.

Students' Reflective Thinking Ability in Solving Mathematical Problems with Kinesthetic Learning Style

Based on the results of the answers to the tests of reflective thinking skills and interviews that have been conducted on the two research subjects selected kinesthetic learning styles, namely ZEA and IAL subjects in solving math problems, in the Reacting phase the two subjects were able to state what they knew and asked in questions correctly and completely. The subjects have been able to determine the relationship between what was being asked and what was known from the questions given correctly and precisely by making a mathematical model from the information he gets. The subjects also stated that the information they had obtained was sufficient to solve the problems given by giving a response "The information I have obtained is sufficient". However, both subjects were unable to identify the

most effective method for solving the problem. Both subjects responded, "The effective method is the method of elimination". Even though according to Prayitno (2016) that the combined or mixed-method was a more efficient method for solving the Linear Equation with Two Variables problem. This was following the results of research by Mentari et al. (2018) which states that students in the kinesthetic learning style were still unable to identify a formula or concept used to solve the problems given.

In the Comparing phase, the subject of the kinesthetic learning style can explain the meaning of the problem given in the question correctly and precisely; the subject has also been able to connect the problem being asked with problems that have been faced before; However, during the written test, the subjects of the kinesthetic learning style were still unable to connect the problems given in the questions with the problems they had faced before. During the interview, the subjects responded in a slow tone, which showed doubt. The response given by the ZEA subject was "The method used was almost the same", while the IAL subject gave the response "I don't know, maybe both were looking for the change received". This was following the opinion of Mentari et al. (2018) that kinesthetic subjects have difficulty connecting relevant and irrelevant data.

In the Contemplating phase, the kinesthetic learning style subject can determine the result of one variable correctly, but the other variable was wrong. In this case, the subject can determine the price of French-fries correctly but was still wrong in determining the price of mocha boba float. This happened because the subject wrote the wrong model for the substitution process. In Figure 4, you can see the subject writing the equation "3x = 3y = 111.600". Even though the correct equation should be "4x = 3y = 111.600". This causes the calculation process to find the result of the variable y to be wrong. Obtaining the incorrect results of the y variable causes the auditory subject to give inaccurate conclusions as seen in Figure 5. This was following the results of research by Jaenudin et al. (2017) which states that students in the kinesthetic learning style first complete all questions completely but the answers are obtained wrong.

Figure 4. Subject IAL's error in writing modelling on substitution

Figure 5. The conclusions produced by the IAL subject

The mistakes made by the two subjects could not be detected by the subjects. However, both subjects believed that there was doubt in themselves on the answers they produced. This can be seen from the response stating "I'm still not sure whether my answer is correct or not". At the time of the interview, it was discovered that this doubt was due to the strange price, which was Rp 20.666,00. However, the subject was unable to detect what he was doing wrong. This was different from the research results of Jaenudin et al. (2017) that in evaluating/checking the truth of the kinesthetic subject can determine the truth value by providing reasons based on the calculations obtained.

Based on the description described above, it can be seen that the kinesthetic learning style subject can go through the three phases of reflective thinking, namely Reacting, Comparing, and Contemplating, but there are several indicators of reflective thinking skills that are not fulfilled.

Therefore, it can be concluded that the kinesthetic learning style subject reaches the level of reflective thinking ability at the Reflective Enough level. This was following the opinion of Mentari et al. (2018) which states that students with kinesthetic learning styles have lower reflective thinking skills than students in visual and auditory learning styles.

Conclusion

Visual learning style subjects can go through the three phases of reflective thinking, namely Reacting, Comparing, and Contemplating with each indicator of each phase of reflective thinking being fulfilled. Although initially, in the Comparing phase during the written test the subject was incomplete in writing down the intent of the problems given in the question, at the time of the interview the subject was able to express and complete these deficiencies correctly and completely. So it can be concluded that the visual learning style subject reaches the level of reflective thinking ability at the Reflective level.

Auditory learning style subjects can go through the three phases of reflective thinking, namely Reacting, Comparing, and Contemplating with each indicator of each phase of reflective thinking being met. Even though initially, in the Reacting phase during the written test the subject was incomplete in writing what was known and what was asked in the questions, but at the time of the interview the subject was able to reveal and complete the deficiencies of what was known and what was asked in the questions given correctly and complete. So that the auditory learning style subject reaches the level of reflective thinking skills at the Reflective level.

Kinesthetic learning style subjects can go through the three phases of reflective thinking, namely Reacting, Comparing, and Contemplating, but there are several indicators of reflective thinking skills that were not fulfilled. In the Reacting phase, the subject was still unable to mention the method that was considered the most effective to be used in solving the problem. In the Comparing phase, the subject was less able to relate the problems given to problems that have been faced before. In the Contemplating phase, the subject cannot detect the truth of the answer he has obtained. So it can be concluded that the kinesthetic learning style subject reaches the level of reflective thinking ability at the Reflective Enough level.

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